

Effects of abdominal stabilization manoeuvres on the control of spine motion and stability against sudden trunk perturbations.

J Vera-Garcia; J Elvira; S Brown; S McGill.
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Reviewed by: **Trish Wisbey-Roth**

Stuart McGill latest research comparing abdominal drawing in versus abdominal bracing.

Results looked at abdominal activation patterns, lumbar movement and compression forces.

The 12 healthy subjects without history of low back pain were instructed while keeping a neutral lumbar spine position, to isometrically tighten their abdominals with two different techniques:-

1. Bringing the navel up and in towards the spine so as to draw in the lower and deeper abdominals (i.e. abdominal hollowing) as in O'Sullivan et al, 1998.
2. Isometrically contract all abdominals without any change in the position of the muscles(i.e. abdominal bracing) as in Kavcic et al 2004.
3. EMG electrodes placed on internal oblique were used to train the subjects in the two different techniques, while 12 muscles around the abdominals, lumbar and thoracic spine were monitored with EMG (Myotrack).
4. Lumbar spine kinematics were measured using the 3D ISOTRAK which was strapped to the sacrum and receiver on T12 so movement of the lumbar spine (as a whole) in all three dimensions could be monitored.
5. The subjects performed 3 trials of each hollowing, bracing while not knowing when an external force would be applied and finally their own pattern but knowing when the external force would be applied. Via use of the EMG they were instructed to perform each of these 3 tasks at 10%, 15% and 20% of internal oblique maximal voluntary contraction.
6. During these contractions an external force was applied from a posterior direction which caused the lumbar spine to extend.
7. The study monitored the ratios of abdominal activation (IO, EO and RA) compared with the amount other trunk muscles were activated. The study also monitored how much the lumbar spine from sacrum to T12 as a whole moved in space and the levels of compressive forces generated within the spine during each manoeuvre.

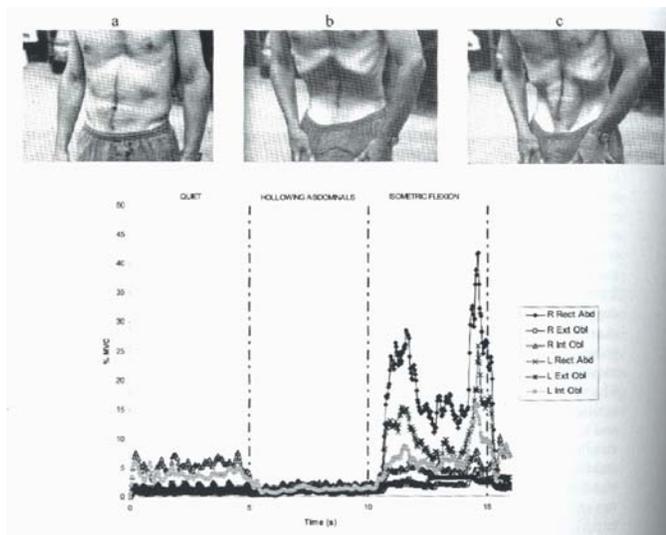
What were the findings and how do we interpret them to improve our clinical practice

Some of the results of the study are very interesting but just as interesting are some of the conclusions and assumptions that are made from the findings. Following are some of these findings, conclusions and my commentary on the conclusions drawn:-

1. No differences in internal oblique activation were noted between the two stabilisation manoeuvres. Interestingly when the subjects knew and expected an external load, the subjects automatically activated the trunk muscles to a similar magnitude to those observed during the bracing or hollowing at 10% of internal oblique. Therefore training to 10% MVC for spinal stability is valid.
2. Using surface EMG electrodes on internal oblique as biofeedback, the subjects were able to differentiate the two abdominal stabilisation manoeuvres at 10%, 15% and 20% MVC internal oblique activity. They claim that no subject was able to accomplish hollowing by activating



Picture 1:
Transverse training with
Real time ultrasound



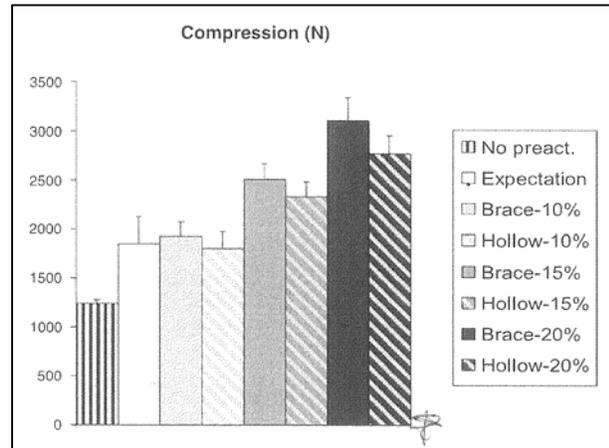
deep abdominals alone (i.e. only with Trans abdominals). The study team's interpretation of hollowing however is very different from the subtle technique practiced by many Physios in Australia. Pictures of the McGill style of hollowing¹ is strongly pulling in the whole abdominal area towards the spine so the abdominal area in fact appears hollow. It could be argued that "McGill's Abdominal hollowing" is totally different to the subtle activation of deep abdominals as taught under ultrasound retraining and used to retrain intersegmental spinal stability.

3. At each % internal oblique activity, lumbar compression forces and the amount of gross lumbar spine movement minimised were greatest with the abdominal bracing technique. McGill's team then concludes that this technique gives greater stability of the spine. One could argue however that limiting gross lumbar spine movement and increasing compression of the spine is not the objective of optimal dynamic spinal stability. The aim of spinal stability, it could be argued is to minimise intersegmental excessive mobility (without excessive compression) while allowing

normal spinal movement. If this is considered ideal stability then the abdominal hollowing was more effective in dynamic stability.

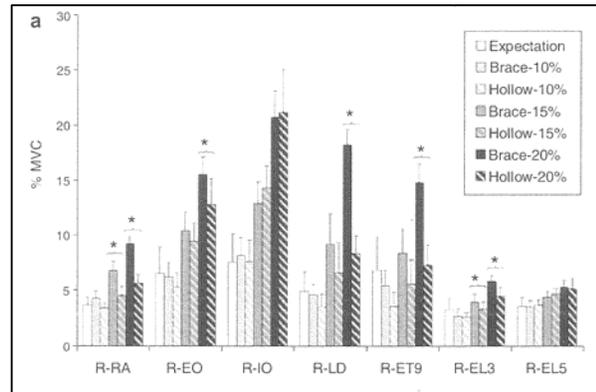
Only gross and not intersegmental movement was tested and this remains a significant limitation of the study.

4. Rapid posterior loading of the lumbar spine while semi-seated mainly activated the abdominals rather than the back extensors. When the load was unexpected, the activity of lat dorsi and the thoracic erector spinae was also considerable. These findings reinforce that abdominal activity in regards to their stabilising function should be retained with the lumbar spine moving into extension and not into lumbar flexion as commonly practiced in Pilates and in Gyms. It also demonstrates that Thoracic erector spinae strength and control (and perhaps even lat dorsi) are important when retraining dynamic lumbar stability into extension. BOUNCE Back exercise classes incorporate all these findings within their exercises.



Graph Compression Pg 562

5. In healthy subjects without back pain, the natural manoeuvre chosen by the subjects to stabilise the trunk when the timing of the load is known, resulted in the best cost benefit relationship with smaller compressive forces imposed on the spine. In exercise retraining and in ADL and work situations this means knowing the timing of an applied force to the spine is the most important factor in protecting against potential injury. That the subjects were healthy without a history of back pain is a limitation of the study as it may not be appropriate to generalise the results to patients with low back instability.



Graph Fig 6 pg564

6. When retraining abdominal recruitment patterns the EMG biofeedback system was a great help for teaching, learning and controlling the correct spinal muscle co activation patterns.

ⁱ McGill, S.M. Ultimate back fitness and performance, Third Edition, Backfitpro Inc., Waterloo, Canada, 2006. (www.backfitpro.com)